A.D. 1898. Oct. 6. N° 21,084.

THOFEHRN'S Complete Specification.

FIG. 1.

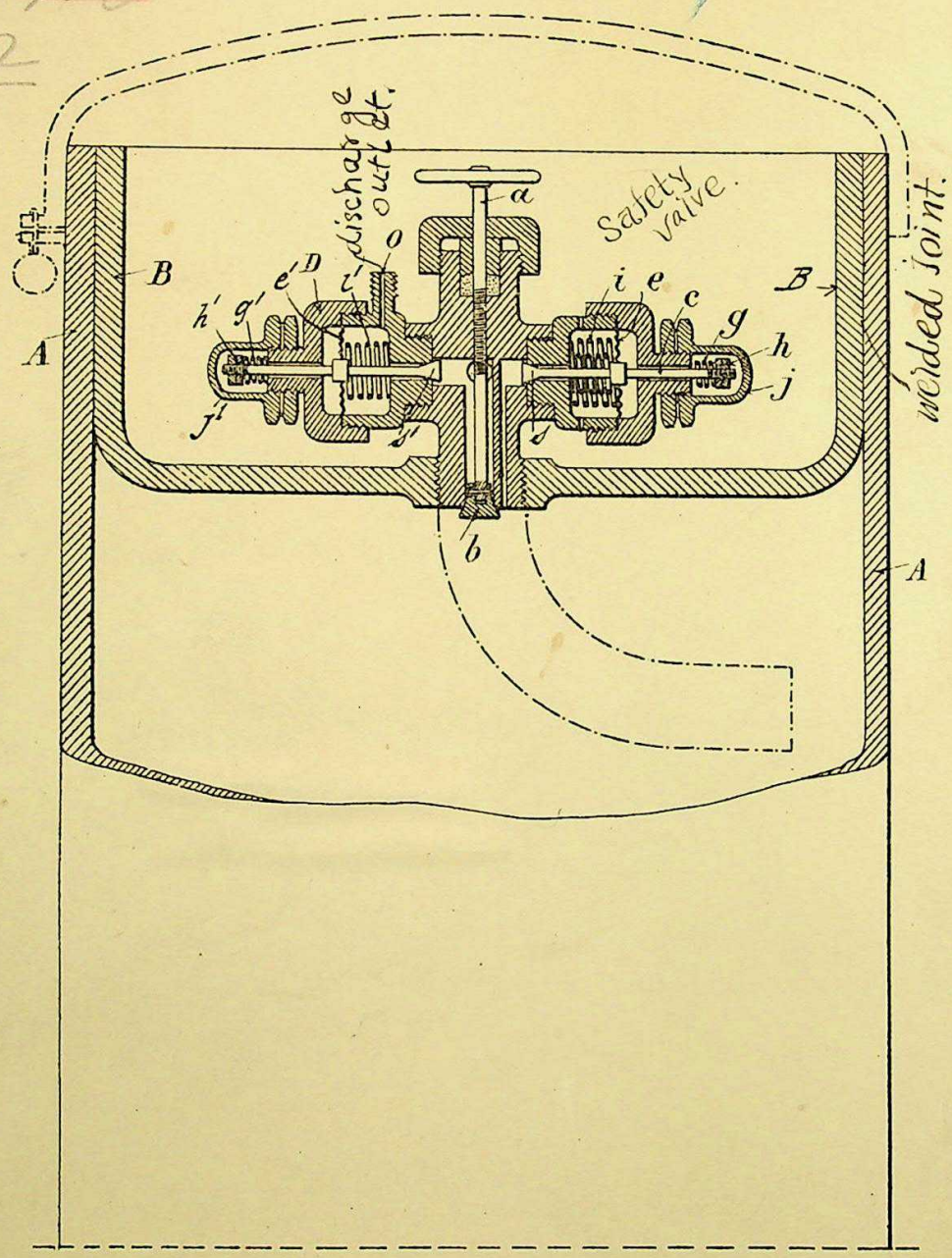


FIG. 2.

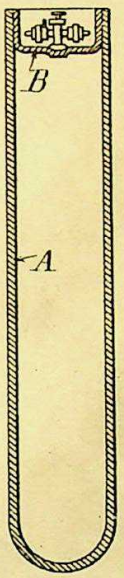


FIG. 3.

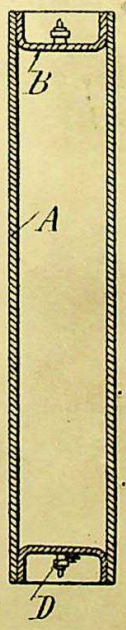
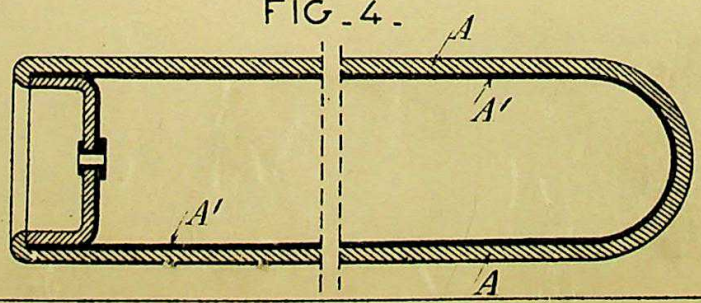


FIG. 4.



220. Metallic Shipping & Storing Vessels, Casks, Soda Water, Vessels.

FIG. 5.

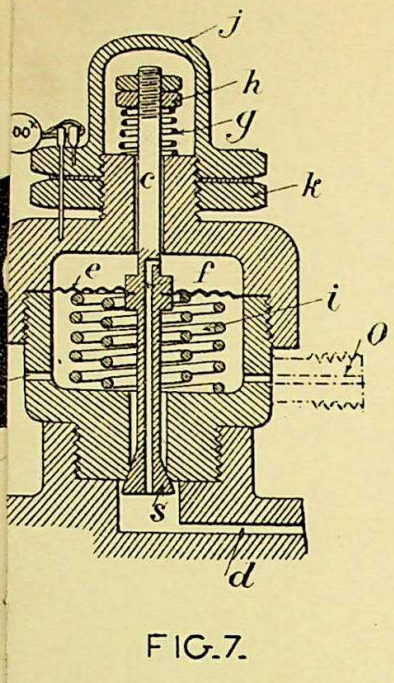


FIG. 6

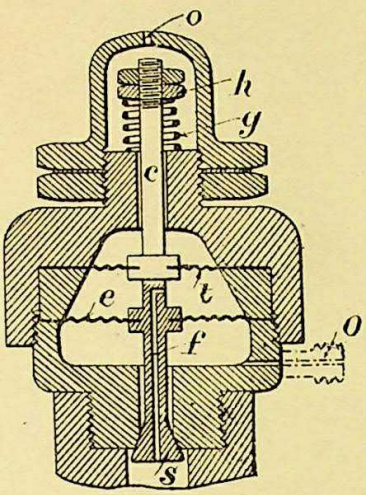


FIG. 7.

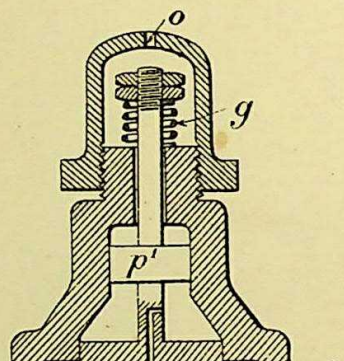
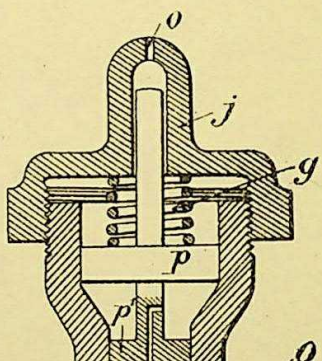


FIG. 8.



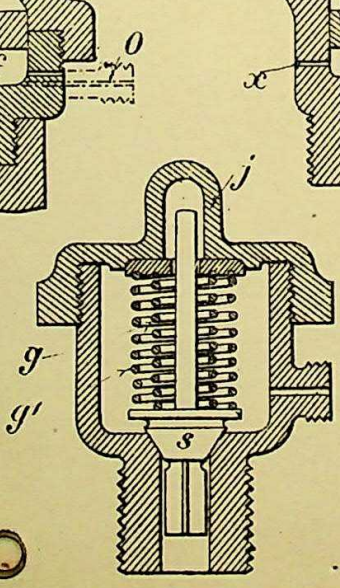


FIG. 9.

[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Litho.

N° 21,084 A.D. 1898

Date of Application, 6th Oct., 1898
Complete Specification Left, 5th July, 1899—Accepted, 26th Aug., 1899

DUPLICATE

PROVISIONAL SPECIFICATION.

Improved Receiver for Liquefied Gas or Gas under Pressure.

I, HERMANN GEORGES CHRISTIAN THOFEHRN, of 93, Rue Miromesnil, Paris, in the Republic of France, Engineer, do hereby declare the nature of this invention to be as follows:—

This invention relates to a receiver for liquified gas or gas under pressure and is essentially characterized by its distribution and safety mechanism and the constructive disposition of the body of the receiver to shelter these parts and equally prevent violation and accidental injury which they otherwise might suffer during transport or use.

The safety mechanism consists of a differential safety valve and the distribution mechanism consists of a differential outlet valve, assuring convenient outlet between the receiver and the escapement pipe in order to give a discharge under constant pressure and determined in advance.

Concerning the body of the receiver, it has at one or each of its extremities a dished cap or end piece the hollow part of which is turned towards the exterior and on the bottom of which the distribution and safety apparatus are fixed being thus protected against injury by the walls of this cap. The cap is passed into the receiver till its borders touch those of the receiver and the two walls are then welded together on their whole circumference.

The bottom of the cap is perforated and in this hole is screwed the valve body which carries two safety and outlet valves or one of them. In case two valves are in the same body through the latter there passes a rod on whose lower end a conical valve is attached. In this body two passages are made, one going to the safety valve and the other going to the outlet valve.

The construction of the differential safety valve can be varied but its working is always the same.

In one arrangement this valve consists in a valve whose widened extremity is subject to the pressure of the receiver and whose rod is fixed on a metallic vibratory diaphragm, one of whose faces is subject to the pressure of the receiver and the small channel and the other face to the atmospheric pressure.

The pressure upon the vibratory diaphragm tends always to open the valve and to let the fluid escape under atmospheric pressure, but this escape must not happen till a certain pressure has been surpassed. One obtains this result by arranging a spring round the rod of the valve and compressing this spring between the valve and a screw, screwed on the extremity of the latter. In regulating the tension of this screw and its counter screw, one compresses more or less the spring and since the valve can only open after surmounting the resistance of the spring, the maximum pressure in the receiver is thus regulated.

In order to facilitate this regulation by diminishing the pressure on the spring one can divide a part of this pressure upon two or other concentric springs arranged under the vibratory diaphragm and acting in the same direction as the former spring.

[*Price 8d.*]

A dome encloses the end of the rod of the valve and the screw and a steam tight joint is formed by the pressure of a metallic or other washer between this dome and a counter nut.

One can prevent the opening of the dome by means of a lead seal. The outlet valve is of analogous construction to the safety valve and works in the same manner. The only difference being that the chamber arranged below the vibratory diaphragm communicates with the out flow passage wherein there is a certain pressure, instead of communicating with the atmosphere. When the outlet valve is arranged alone upon the apparatus, this passage is provided with a cock which is closed when the out flow is to stop, whilst when the out flow valve is combined with a central valve body it is sufficient to make its passage pass into the central passage of the centre valve body then the out let valve does not begin to work till one opens the central valve by means of its rod. In another form the spring or springs arranged under the diaphragm and working in the same sense as the spring at the end of the valve rod are suppressed and replaced by a second diaphragm, parallel to the first diaphragm but of different diameter. The pressure upon the second diaphragm tends always to lift the valve that is to say this action reinforces the effect of the regulating spring and the pressure upon the extremity of the valve.

In another form the two diaphragms may be replaced by two pistons. This arrangement is principally advantageous for very high pressures; the pistons are of different diameters where the larger piston is uppermost, the construction may be reversed so that the valve opens outwardly.

Dated this 6th day of October 1898.

HERBERT HADDAN & Co.,
Agents to Applicant.

COMPLETE SPECIFICATION.

Improved Receiver for Liquefied Gas or Gas under Pressure.

I, HERMANN GEORGES CHRISTIAN THOFEHRN, of 93, Rue Miromesnil, Paris, in the Republic of France Engineer, do hereby declare the nature of this invention and in what manner the same is to be preformed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a receiver for liquified gas or gas under pressure and is essentially characterized by its distribution and safety mechanism, and the constructive disposition of the body of the receiver, to shelter these parts and equally prevent violation and accidental injury which they otherwise might suffer during transport or use.

The safety mechanism consists of a differential safety valve and the distribution mechanism consists of a differential outlet valve, assuring convenient outlet between the receiver and the escapement pipe in order to give a discharge under constant pressure and determined in advance.

Concerning the body of the receiver, it has at one or each of its extremities a dished cap or end piece, the hollow part of which is turned towards the exterior and on the bottom of which the distribution and safety apparatus is fixed, being so thus protected against injury by the walls of this cap.

The safety valve and the distributing mechanism can be separately arranged in which case the receiver is provided with a dished cap at each extremity in which the valve and the distributing mechanism are respectively contained. In the annexed drawing Fig. 1 is a section of part of the apparatus, with one cap in which the safety valve and distributing mechanism are arranged together.

Figs. 2 and 3 show on a small scale sections of receivers provided with one and two caps respectively.

Fig. 4 is a section of a receiver provided with a lining on its internal sides.

Fig. 5 is a section on a large scale of a safety valve with one diaphragm and compensating springs.

Fig. 6 is a similar view of a safety valve having two diaphragms.

Figs. 7 and 8 show two other constructions of valve.

Fig. 9 shews a simplified construction of the distributing valve.

In Figs. 5 and 8 simple means are shewn for transforming the safety valve into distributing valve.

The cap B is passed into the receiver A till its borders touch those of the receiver and the two walls are then welded together on their whole circumference.

The bottom of the cap B is perforated and in this hole is screwed the valve body which carries two safety and outlet valves Figs. 1 and 2 or one of them (Fig. 3).

To prevent fraud a cover can be arranged on the dished cap which carries the safety valve and distributing mechanism, of which the closure can be effected by a suitable packing or lead seal.

The apparatus can further be provided interiorly with a pipe for the reception of the gas preventing the liquid from flowing directly in the distributors when the apparatus A is in the horizontal position. To prevent any gas passing through the sides of the receiver or any corrosive action of the gas on the same I can arrange in the internal surface of the receiver a lining A^1 (Fig. 4) of copper, bronze, or other metal or any other substance such as glass, ebonite, varnish or the like.

In case two valves are in the same body Fig. 1 through the latter there passes a rod *a* in whose lower end a conical valve *b* is attached. In this body two passages are made, one going to the safety valve and the other going to the outlet valve.

The construction of the differential safety valve can be varied, but its working is always the same.

In the arrangement represented in Figs. 1 and 5 this valve consists of a valve piece *c*, whose widened extremity or valve *s* is subject to the pressure of the receiver through the channel *d* and whose rod is fixed on a metallic vibratory diaphragm *e*, one of whose faces is subjected to the pressure of the receiver coming through the channel *d* and the small channel *f* and the other face to the atmospheric pressure.

The pressure upon the vibratory diaphragm *e* tends always to open the valve *s* and to let the fluid escape under atmospheric pressure, but this escapement must not happen till a certain pressure has been surpassed. This result is obtained by arranging a spring *g* round the rod of the valve and compressing this spring between the valve pin and the screw *h*, screwed on the extremity of the latter, in regulating the tension of this screw *h* and its counter screw, one compresses more or less the spring *g* and, since the valve can only open after surmounting the resistance of this spring, the maximum pressure in the receiver is thus regulated.

In order to facilitate this regulation by diminishing the pressure on the spring *g* a part of this pressure can be taken by two other concentric springs *i* arranged under the vibratory diaphragm *e* and acting in the same direction as the former spring *g*.

A dome *j* encloses the end of the rod of the valve and the screw *h* and a gas tight joint is formed by the pressure of a metallic or other washer, between this dome and a counter nut *k*.

The opening of the dome *j* can be prevented by means of a lead seal.

The outlet valve D (Fig. 1) is of analogous construction to the safety valve and works in the same manner. The only difference being that the chamber arranged below the vibratory diaphragm *e* communicates with the out flow passage wherein there is a certain pressure, instead of communicating with the atmosphere.

When the outlet valve is arranged alone upon the apparatus, this passage O is provided with a cock which is closed when the out flowing is to stop, whilst when the outlet valve is combined with a central valve body as shown in Fig. 1 it is sufficient to make its passage into the central passage of the centre valve body, then the outlet valve does not begin to work until the central valve *b* is opened by means of its rod *a*.

If the pressure in the receiver is 100 kilos., and a constant pressure of 10 kilos. in the outlet O is required (Fig. 1) the surface of s^1 and that of the membrane e^1 will be in harmony with these pressures. The apparatus can be regulated by means of a gauge and in compressing the spring g^1 by means of the screw h^1 or by means of the cap j^1 until the gauge shews 10 kilos. The distributor is sealed in a similar manner to the safety valve. One or more auxilliary springs l^1 can be placed inside the membrane e^1 so as to diminish the efforts of the spring g^1.

The construction of Fig. 5 is suitable for the distributor by suppressing the holes *x* passing to the atmosphere and replacing them by adding the part *o* represented in dotted lines in this figure; upon this piece *o* the out flowing pipe is attached.

In the arrangement of Figure 6 the safety or distributor valves are provided with a centre pin *c* whose end is fixed on a metallic diaphragm *e* and bears with one of its faces the pressure from the receiver forwarded through the small channel *f* and with the other face the atmospheric pressure for the safety valve and the pressure in the out flowing pipe O for the distributor. Also a regulating spring *g* is here arranged round the centre pin which can more or less be compressed by means of the screw *h*; but the spring or springs *i* arranged under the diaphragm *e* and working in the same sense as the spring *g* at the end of the valve rod are suppressed and replaced by a second diaphragm *t*, parallel to the first diaphragm *e*, but of different diameter.

The pressure upon the second diaphragm *t* tends always to lift the valve *c* that is to say this action reinforces the effect of the regulating spring *g* and the pressure upon the valve *s*.

It is necessary that the amount of the surfaces of *s* and of the diaphragm *t* should always be a little less than the surface of the diaphragm *e*. The resulting effort which tends to make the valve sink is balanced by the pressure, to be regulated, of the spring *g* reinforced, in the case of the distributor only, by the pressure in the out flowing pipe coming from below upon the whole surface of the diaphragm *e*.

In the forms of construction shewn in Figs. 7, and 8 the two diaphragms may be replaced by two pistons *p* and p^1. This arrangement is principally advantageous for very high pressures; the pistons are of different diameters; where the larger piston is uppermost the construction may be reversed so that the valve opens outwardly.

In Fig. 7 the larger piston *p* corresponding with the diaphragm *e* is arranged in the lower part, the fluid under pressure arrives through the channel *f* between the two pistons and as soon as the pressure grows too strong the entire valve part sinks and the valve *s* terminating the centre pin opens and lets the fluid escape into the atmosphere by the orifice *x* or into the out flow pipe O shewn in dotted lines.

In Fig. 8 the large piston is arranged above the small piston so that the augmentation of the pressure tends to lift the movable system. In this case the valve opens upwards as shown in the drawing and the regulating spring tends by its compression to make the pistons descend; for this purpose this spring is seated directly upon the piston *p* and abutts under the cap *j* which has a central extension for the upper extremity of the valve pin.

The regulation is here effected by screwing more or less the cap *j* upon the body of the apparatus.

It may be remarked that in the employment of diaphragms I can place the larger one at the upper part and arrange the valve so as to open upwards.

The distributor may be arranged in a simplified manner as shewn in Fig. 9. The valve body is provided with two openings one in connection with the receiver and the other with the out flow pipe. Between the cap *j* and the valve *s* are two springs *g* g^1 which tend to press the valve on its seat. This valve is submitted to the pressure from the receiver on one side and on the other to the pressure of the springs *g* g^1 augmented by the pressure in the out flow pipe. The valve opens or closes according to the balance of pressure.

To obtain a constant pressure in the pipe springs are regulated by the cap *j*.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

1. An improved receiver for liquified gas or gas under pressure having a safety mechanism and mechanism for the distribution at a constant pressure, each having a differential valve, the two faces of which are submitted to different pressures from the liquid and one of them to the action of adjustable tension springs, in combination with a receptacle the sides of which are gas tight and impermeable and which has at one or both of its extremities a dished cap, with its concave part turned outwards and its edges welded to those of the receptacle; the bottom of this dished cap receiving the two valves aforesaid arranged on one and the same body when there is one dished cap only, or if two dished caps the bottom of each carries one of these valves in such a manner that the valve mechanism is protected by the borders of the said caps against blows and shocks during transport or use.

2. In an improved receiver for liquified gas, or gas under pressure as in Claim 1 a receiver body provided with an internal lining of material, impermeable and unattackable by the gas, this body having at one or both of its extremities a dished cap with its edges welded to those of the receptacle, its concavity turned towards the outside substantially as herein described and illustrated in the annexed drawing.

3. In a receiver for liquified gas or gas under pressure as in Claim 1 a safety valve or mechanism having a pin *c* which is attached to the membrane *e* or to a large piston *p* receiving the pressure of the recipient on one of its faces and this pressure being equalised by the pressure of the fluid on the valve *s* of small surface by a regulatable pressure spring *g*, and by auxilliary springs *i* or by a second diaphragm *t* smaller than the diaphragm *e* or by a second piston p^1 smaller than the piston *p*, in such a manner that if the pressure in the receptacle rises beyond a given point the excess of pressure escapes with the atmosphere.

4. In a receiver for liquified gas or gas under pressure a distributing mechanism or valve having a valve pin *c*, a diaphragm *e* a compensating spring *i* or two diaphragms *e* and *t* of different sizes or two pistons *p* and p^1 of different diameters, and a spring *g* of regulatable tension, or simply two regulatable springs *g* g^1, in such a manner that the regulation of the springs fixes the pressure in the out flow pipe and when this regulation of the springs is effected the gas can only flow out at a constant pressure.

Dated this 5th day of July 1899.

HERBERT HADDAN & Co.,
Agents to Applicants, 18, Buckingham Street, Strand, London.

Redhill: Printed for Her Majesty's Stationery Office, by Malcomson & Co., Ltd.—1899.